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EXPERIMENTAL DAMPING
STUDIES


MONTHLY PROGRESS REPORT

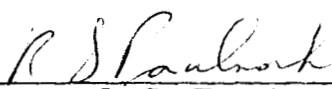
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Contract NAS8-20088

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Huntsville, Alabama

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FOREWORD

This document contains a report of progress on Experimental Damping Studies, Contract NAS8-20088, covering the period 6 October to 5 November 1965. The purpose of this study is to:

- investigate analytical procedures for determining damping properties of complex structures
- develop improved experimental techniques for measuring damping
- prepare and conduct an experimental study of the above techniques using the Langley 1/5-scale model of the Saturn I vehicle.
- compare results with those obtained from full-scale Saturn I tests, and
- compose a detailed technical report describing the results of the developmental program.

SUMMARY

Analyses of the dynamic test data for the 1/5-scale model of Saturn I are near completion. Graphical work on the relationships among modal damping, response amplitude, natural frequencies, forcing amplitude, and fuel-level are being prepared.

Digital computer analyses of the modes and frequencies are also near completion.

A final test report, summarizing all experimental work, has been completed and was published on 11 October 1965 by the Lockheed-Georgia Company.

WORK ACCOMPLISHED

Data Analyses

From steady-state and free vibration measurements, modal damping values were computed and correlated with the peak total (kinetic) energy level of the 1/5-scale model of Saturn I. These relationships are shown in Figures 1 through 3 for each mode and each fuel configuration. It can be seen from these figures that the model was tested over a wide, but consistent, range (35 db) of energy level, and that in each mode the modal damping value can vary appreciably. With only one exception, modal damping increases with the excitation or response amplitude for the 1/5-scale model. For each fuel condition, there are considerable differences in the damping values among the tested modes. Both of these noted characteristics are different from the behavior of damping of a full-scale test vehicle SAD-6 (see Reference 1).

The computation of kinetic energy levels which are used in preparing Figures 1 through 3 were based on generalized mass values obtained by a new approach developed during the course of this project. Since the generalized masses were measured in a separate series of tests, and since some discrepancies are observed for some cases, further analyses of damping data will be needed before conclusions can be reached.

Computer Analyses

The digital computer program for analyzing the modes and frequencies of the model have been completed. Final computations will be completed in November.

Reference 1: Damping in Multi-Beam Vibration Analyses, Part II, Damping Properties of Saturn I Dynamic Test Vehicle SAD-6, LMSC/HREC A710166, November 1964.

The generalized masses predicted by this program will also be incorporated in the final analyses of damping properties.

Final Report

Graphical work for the final technical report is well under way.

PLANS FOR NEXT PERIOD

- Complete all analytical work
- Complete rough draft of the final report.

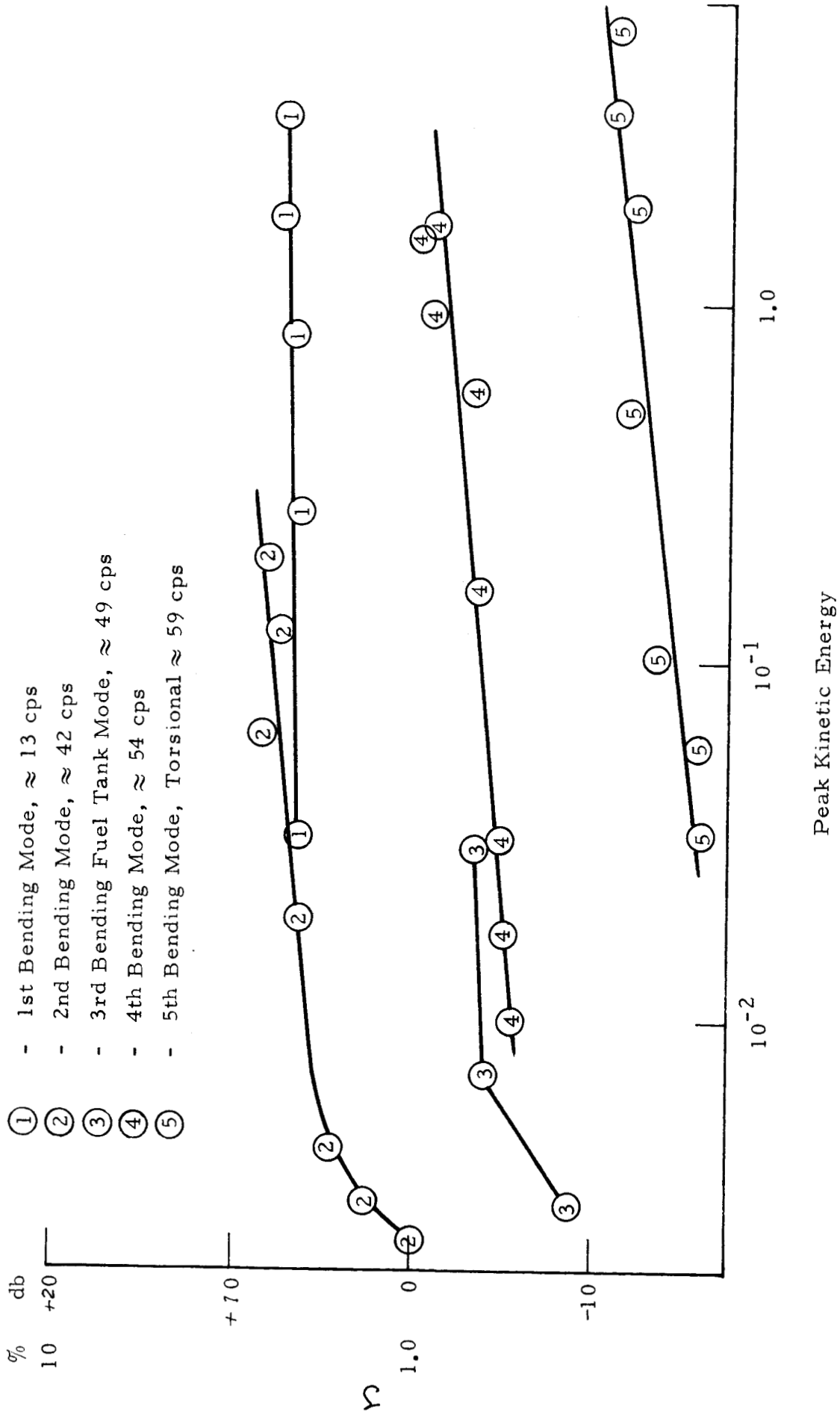


Figure 1 - Modal Damping vs. Total Kinetic Energy, Booster Empty

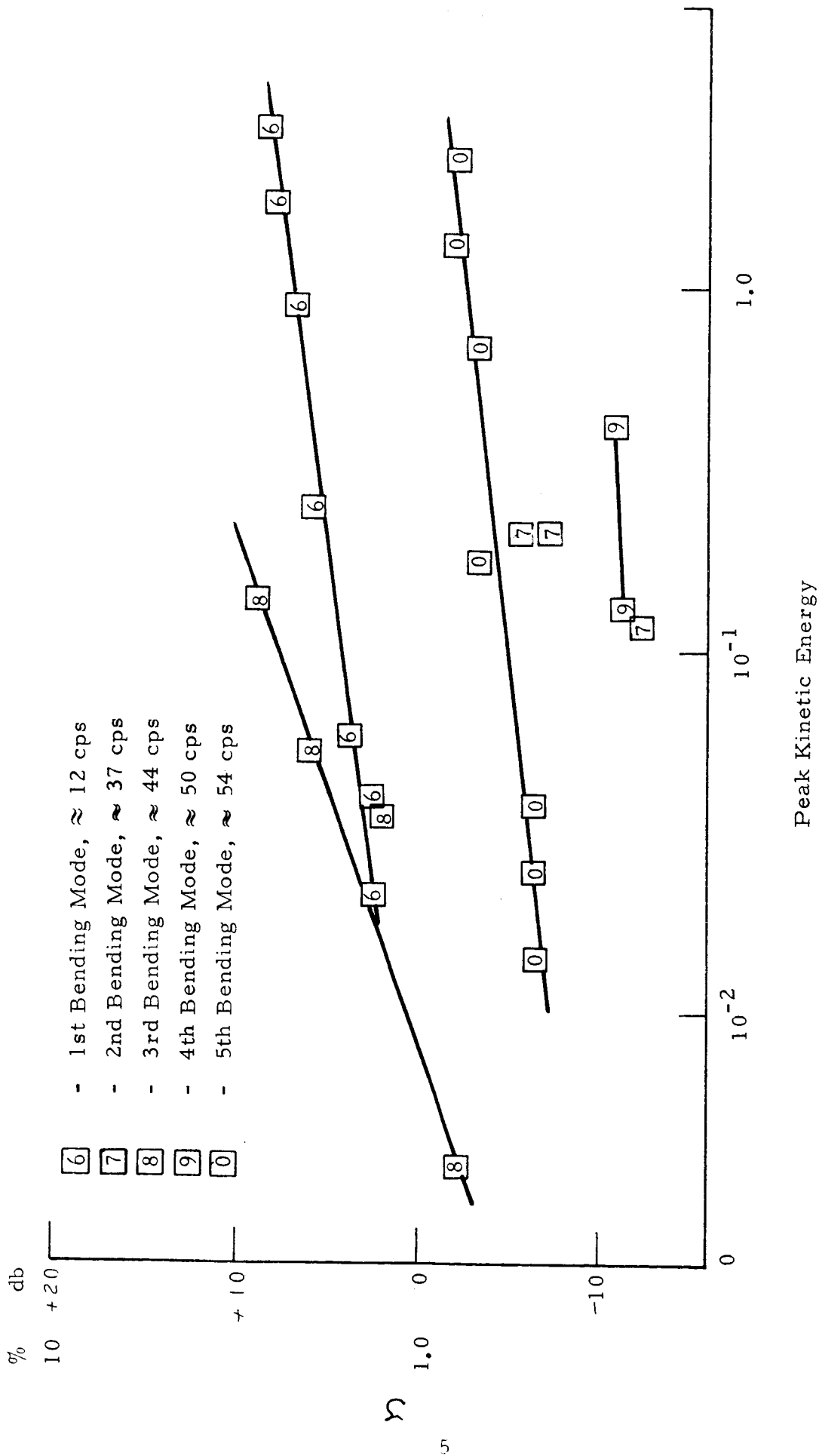


Figure 2 - Modal Damping vs. Total Kinetic Energy, Booster 48% Full

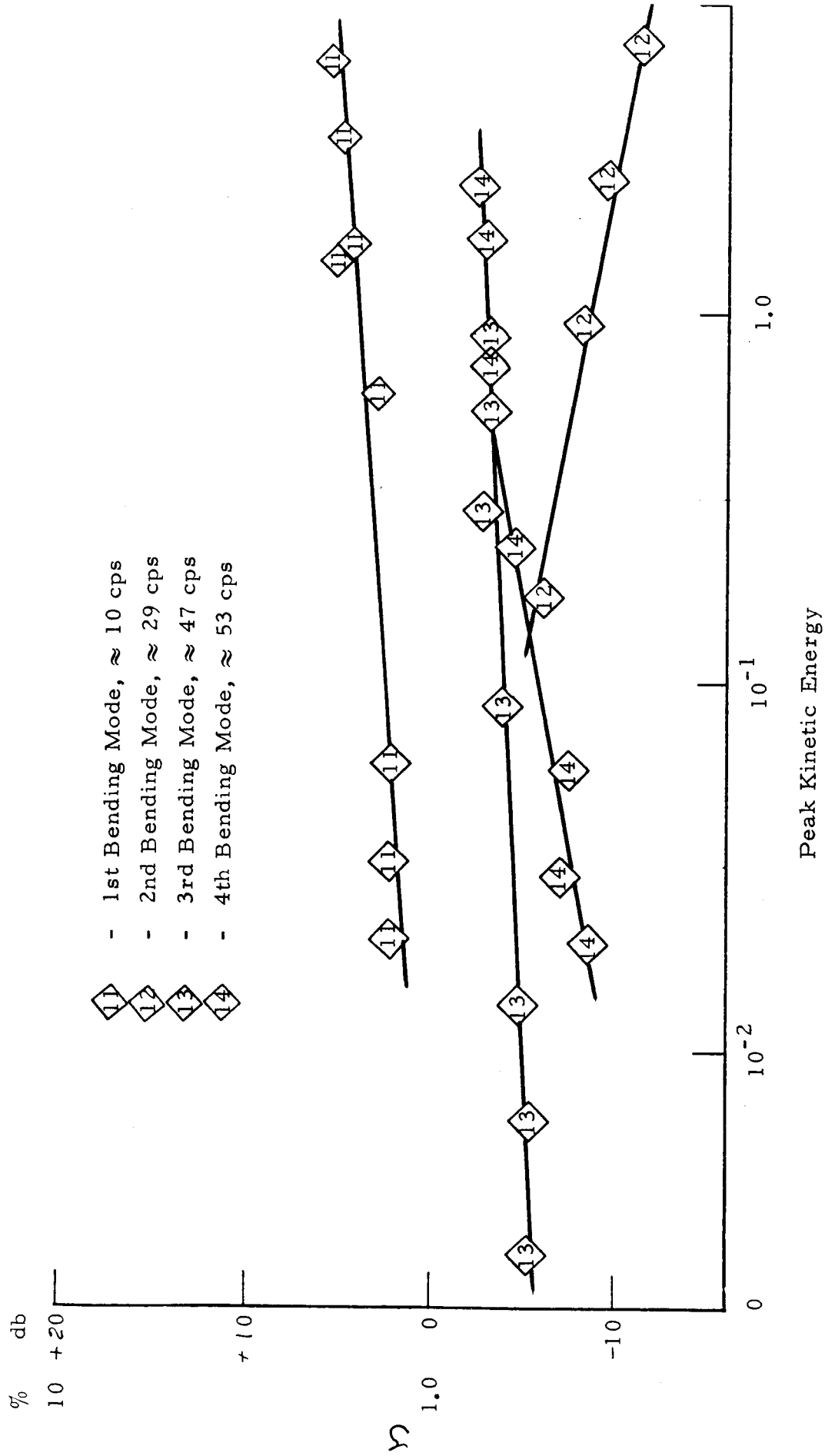


Figure 3 - Modal Damping vs. Total Kinetic Energy, Booster Full